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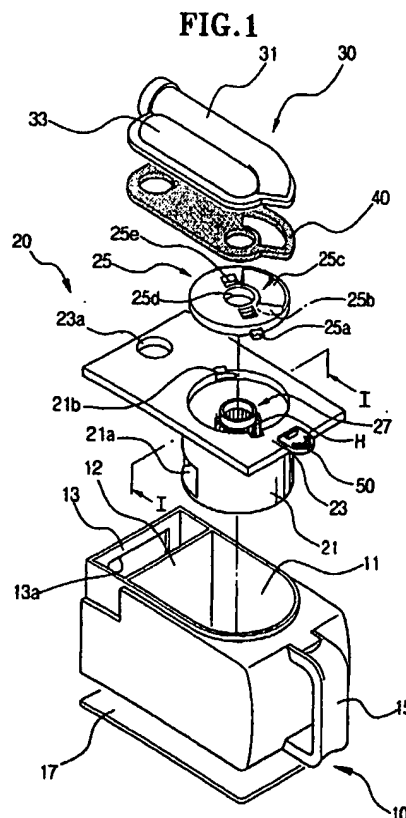
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(54) Abstract Title

Cyclone dust collecting apparatus for use in a vacuum cleaner

(57) A cyclone dust collecting apparatus includes: a contaminant receptacle 10 having a contaminant chamber 11 and an air discharge chamber 13, the contaminant chamber and the air discharge chamber each having open upper sides and being partitioned from each other; a cyclone unit 20 having a cover plate 23 connected to an upper portion of the contaminant receptacle to cover the contaminant chamber and the air discharge chamber, the cyclone unit further having apertures 25b, 25c, 23a corresponding to, (i) an incoming air port through which contaminant laden air enters into a centrifuging chamber for separating contaminants from the air by centrifugal effect, (ii) a contaminant discharge port through which the separated contaminants are discharged, (iii) an outgoing air port through which cleaned air that is left after separation of the contaminants is discharged; and a duct member 30 connected to the upper portion of the cyclone unit, and having an air inflow channel 31 that is connected to the incoming air port and an air outflow channel 33 that interconnects the outgoing air port with the air discharge chamber.

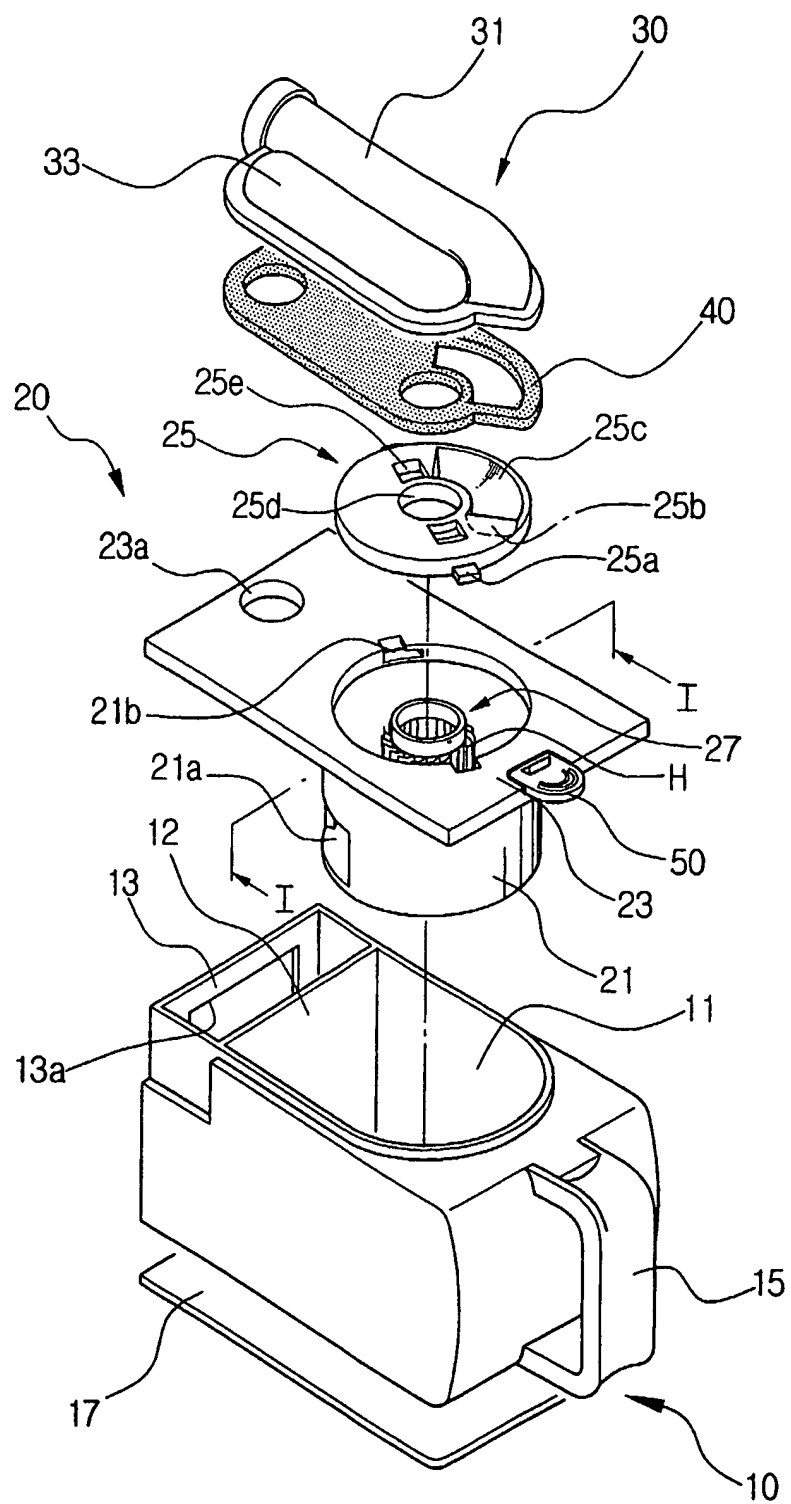


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FIG. 1



**CYCLONE DUST COLLECTING APPARATUS FOR USE
IN A VACUUM CLEANER**

The present invention relates to a vacuum cleaner, and to a cyclone dust collecting
5 apparatus for use in a vacuum cleaner than separates contaminants from air by
centrifugal force and collects the separated contaminants.

Generally, an upright type or canister type vacuum cleaner has a suction brush which is
connected to a cleaner body and is moved along a surface to be cleaned. The cleaner
10 has a dust collecting chamber in which a dust filter is removably mounted and a motor
chamber in which a motor having a fan is mounted to provide a suction force. In such a
cleaner, when the motor is driven, a strong suction force is generated at the suction
brush and air laden with dust and other contaminants from the surface to be cleaned is
drawn into the cleaner body. Thereafter, the air flows through the dust filter where the
15 contaminants are filtered out, and uncontaminated air is discharged via the motor
chamber.

One of the difficulties with the conventional vacuum cleaner is the need for the user to
buy the dust filters, which are consumable items, for continuing efficient collecting of
20 the dust or contaminant. In addition, when the dust filter is fully loaded with
contaminants, the user has to change the dust filter manually, which can be quite
unhygienic and inconvenient.

It is an object of the present invention to provide improved cyclone dust collecting
25 apparatus for use in a vacuum cleaner that separates and collects contaminants from the
incoming air by a centrifugal action.

According to a first aspect of the invention, there is provided cyclone dust collecting
apparatus for use mounted in a dust collecting chamber of a vacuum cleaner, the dust
30 collecting chamber communicating with a motor chamber of a cleaner body, for
centrifugally separating contaminants from air drawn in through a suction brush,

wherein the apparatus comprises: a contaminant receptacle having a contaminant chamber and an air discharge chamber, the contaminant chamber and the air discharge chamber respectively having open upper sides and being partitioned from each other, a cyclone unit connected to an upper portion of the contaminant receptacle so as to cover
 5 the contaminant chamber and the air discharge chamber, the cyclone unit having an aperture corresponding to, respectively, an incoming air port through which foreign-substance-laden air flows in, a centrifuging chamber for separating the foreign substances from the air by a centrifugal effect, a contaminant discharge port through which the separated foreign substances are discharged, an outgoing air port through
 10 which cleaned air that is left after separation of the foreign substances is discharged, and the air discharge chamber; and a duct member connected to the upper portion of the cyclone unit, and having an air inflow channel that is connected to the incoming air port and an air outflow channel that interconnects the outgoing air port with the aperture.

15 The cyclone unit preferably includes a centrifuging receptacle having an open upper end and a closed lower end, and a cylindrical side having the contaminant discharge port formed therein, a cover plate connected to an outside of the centrifuging receptacle, covering the contaminant chamber and the air discharge chamber, the cover plate having the hole formed therein; and a cap cover removably mounted on the centrifuging
 20 receptacle in a manner of covering the open end of the centrifuging receptacle, the cap cover having the incoming air port and the outgoing air port.

The preferred cyclone unit also includes a grille member having an open upper end intercommunicating with the incoming air port of the cap cover, and a plurality of fine
 25 holes formed in a side, and mounted in an interior of the centrifuging receptacle.

The grille member includes a cylindrical body integrally formed on a bottom of the centrifuging receptacle, and having open upper and lower ends; and a lower cover connected to cover the open lower end of the cylindrical body.

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The outgoing air port is formed in the centre of the cap cover, and the incoming air port is formed at an end of an air guide groove that is formed in near to the outgoing air port in a spiral manner.

FIG. 2

- 5 The centrifuging receptacle has one or more locking grooves formed in the upper end, and each locking groove receiving a locking protrusion protruding from the rim of the cap cover to be locked in the locking groove.

10 The cap cover has at least a pair of handle holes formed in an upper side of the cap cover, for rotating the cap cover for locking/unlocking of the cap cover.

The cover plate and the centrifuging receptacle are integrally formed with each other.

15 In between the cyclone unit and the duct member, a sealing member is provided.

20 According to a second aspect of the invention there is provided a vacuum cleaner having cyclone dust collecting apparatus, wherein the cleaner comprises a contaminant receptacle having a contaminant chamber and an air discharge chamber defined by side walls of the receptacle and separated from each other by a partition, a cover extending over the contaminant chamber and the discharge chamber, and, depending from the cover so as to be located within the contaminant chamber, a receptacle defining a centrifuging chamber. The receptacle has a contaminant discharge port for the discharge of contaminants from the centrifuging chamber into the contaminant chamber, and wherein the cleaner further comprises a duct member which overlies the cover member and which has an air inflow channel arranged to communicate with the centrifuging chamber via an incoming air port of the centrifuging chamber for admitting contaminant-laden air to the centrifugal chamber, and an air discharge channel for conveying cleaned air from the centrifugal chamber to the discharge chamber via an aperture in the cover.

30 The invention will now be described by way of example with reference to the drawings, in which:

FIG. 3

Figure 1 is a schematic exploded perspective view of a cyclone collecting apparatus in accordance with the invention.

5 Figure 2 is a cross-sectional view of a centrifuging receptacle of the apparatus of Figure 1 taken along the line I-I in Figure 1; and

Figure 3 is a schematic cross-sectional view of the apparatus of Figure 1, showing its assembly as part of a vacuum cleaner.

10

Referring to Figure 1, cyclone dust collecting apparatus in accordance with the invention includes the assembly of a contaminant receptacle 10, a cyclone unit 20 connected to an upper portion of the contaminant receptacle 10, and a duct member 30 connected to an upper portion of the cyclone unit 20.

15

The contaminant receptacle 10 has a contaminant chamber 11 and an air discharge chamber 13, each upwardly open before connection of the cyclone unit 20. The contaminant chamber 11 and the air discharge chamber 13 are partitioned by a partition 12. The contaminant chamber 11 receives contaminants separated from incoming air by centrifugal force in the cyclone unit 20. The air discharge chamber 13 is a passage through which the clean air from the cyclone unit 20 flows and communicates with a motor chamber 3 in the cleaner body 1 (see Figure 3) where suction is generated by a cleaner motor. Accordingly, in order to connect the air discharge chamber 13 to the motor chamber 3, an opening 13a can be provided in one side of the air discharge chamber 13. On the outer surface of the contaminant receptacle 10 there is a handle 15. Constructed as described above, the contaminant receptacle 10 is removably mounted in a dust-collecting chamber which communicates with the motor chamber. Convenient emptying of the contaminant receptacle 10 is allowed by a removable base 17 for the receptacle 10.

30

The contaminant receptacle 10, the cyclone unit 20 and a cap cover 25 are interconnected as one assembly, and removably mounted in the dust collecting chamber 2.

5 The cyclone unit 20 separates foreign substances from the air drawn through the suction brush by the centrifugal force. The cyclone unit 20 includes a centrifuging vessel or receptacle 21, a cover plate 23 connected to the upper end of the centrifuging receptacle 21, a cap cover 25 connected to an upper end of the centrifuging receptacle 21, and a grille member 27 mounted in the centrifuging receptacle 21.

10

The upper end of the centrifuging receptacle 21 is open whereas the lower end is closed. Formed in the cylindrical side of the centrifuging receptacle 21 is a contaminant discharge port 21a of a predetermined size. The centrifuging receptacle 21 is accommodated in the contaminant chamber 11 when connected to the contaminant chamber 11. The cover plate 23 is integrally formed as a flange on the outer surface of the centrifuging receptacle 21 and is connected to an upper portion of the contaminant receptacle 10 to cover the contaminant chamber 11 and the air discharge chamber 13. The cover plate 23 has a hole 23a formed therein in registry with the air discharge chamber 13. Also formed on the cover plate 23 is a separating button 50 which, in this embodiment, is resiliently formed so as to be movable relative to the main body of the cover plate 23. In this case a locking protrusion is formed on the upper surface of the separating button 50. Accordingly, as the cover plate 23, placed over and connected with the contaminant receptacle 10, is received into the dust chamber 2, the locking protrusion of the separating button 50 engages in a locking groove or aperture formed on the cleaner body 1 and the cyclone unit 20 is mounted in the cleaner body 1 so as to be retained therein. If the user presses the separating button 50 in the locked state, the locking protrusion is released from the locking groove or aperture, and thus, the cyclone unit 20 can be separated from the cleaner body 1.

30 The cap cover 25 is removably connected to the open upper end of the centrifuging receptacle 21. A pair of locking protrusions 25a protruding from the rim of the cap cover 25 engage a pair of locking grooves 21b formed on the upper end of the

centrifuging receptacle 21, i.e. formed on the linking area between the centrifuging receptacle 21 and the cover plate 23, the positions of the locking grooves 21b corresponding to those of the locking protrusions 25a.

5 The cap cover 25 has first and second openings in registry with the interior of the centrifuging receptacle 21. Firstly, formed in the cap cover 25 is an incoming air port 25b through which the foreign-substance laden air flows. More specifically, an air guiding groove 25c is formed in a spiral manner in the cover 25, spaced from the centre of the cover 25 in an outward direction, and the incoming air port 25b is formed at an
10 end of the air guiding groove 25c. Accordingly, when the air flows into the cylindrical centrifuging receptacle 21 along the air guiding groove 25c and through the port 25b, it is made to rotate within the centrifuging receptacle 21 so that a centrifuging force is generated.

15 At a centre of the cap cover 25 is an opening which is an outgoing air port 25d through which cleaned air flows after the foreign substances are removed by the centrifugal force.

A pair of handle recesses 25e is provided near the outgoing air port 25d. Accordingly,
20 by placing the cap cover 25 on the upper side of the centrifuging receptacle 21 and rotating the cap cover 25 with fingers at the handle holes 25e, the user can easily lock or release the locking protrusions 25a in or from the locking grooves 21b.

As shown in Figure 2, the grille member 27 has a cylindrical shape, and includes a
25 tubular grille body 27a protruding axially from a bottom wall of the cylindrical centrifuging receptacle 21, and a lower cover 27b that opens and closes the open lower side of the grille body 27a. A plurality of fine holes (H) is formed in the grille body 27a, each hole being formed as a slot defined between vanes oriented in a circumferential direction. The grille body 27a is integrally formed with the bottom wall
30 of the centrifuging receptacle 21. The bottom wall of the centrifuging receptacle 21 is inclined downwardly in the outward direction away from the axis of the receptacle 21, thereby accelerating the centrifugal effect. The open upper end of the grille body 27a is

connected to the outgoing air port 25d of the cap cover 25. Accordingly, after separation of foreign substances from the air in the centrifuging receptacle 21, the cleaned air is discharged through the fine holes (H), whereas the foreign substances are filtered and discharged through the contaminant discharge port 21a.

5

The duct member 30 includes an air inflow channel 31 connected to the incoming air port 25b, and an air discharge port 33. Air drawn in from the suction brush flows through the air inflow channel 31 to the incoming air port 25b. The downstream end of the air inflow channel 31 is formed in a spiral manner to correspond to the air guiding groove 25c. Accordingly, the air drawn into the incoming air port 25b from the air inflow channel 31 is guided in a spiral path.

10

The air discharge channel 33 connects the outgoing air port 25d of the cap cover 25 to the hole 23a of the cover plate 23. Accordingly, the clean air, discharged through the outgoing air port 25d, flows to the air discharge chamber 13 via the air discharge channel 33, and is discharged into the motor chamber 3.

15

Disposed between the duct member 30 and the cyclone unit 20 is a sealing member 40. The sealing member 40 blocks a leakage from the air stream, and also prevents deterioration of the suction pressure. Preferably, the sealing member 40 is secured between the duct member 30 and the cleaner body 1 by screws for sealing.

20

The duct member 30 constructed as above is connected to the cleaner body 1. Accordingly, when mounting or separating the cyclone unit 20 to or from the cleaner body 1, the cyclone unit 20 is connectible or separable by, for example, surface contact.

25

The operation of the cyclone dust collecting apparatus for use in the vacuum cleaner constructed according to the preferred embodiment of the present invention will be described below.

30

Firstly, as shown in Figure 3, the air is drawn in through the suction brush, and flows into the centrifuging receptacle 21 via the air suction channel 31. When the air is drawn

in, the air is guided to rotate in a spiral pattern generating a centrifugal force that separates foreign substances from the air. The foreign substances separated from the air are collected in the contaminant chamber 11 of the contaminant receptacle 10 via the contaminant discharge port 21a.

5

After the foreign substances are removed from the air, the clean air passes through the fine holes (H) of the grille member 27 and is discharged through the discharge channel 33. After that, the air is discharged into the motor chamber through the air discharge chamber 13.

10

When the contaminant receptacle 10 is filled with foreign substances, the user separates the cyclone unit 20 from the contaminant receptacle 10, and then empties the contaminant receptacle 10.

15 In order to clean the interior of the centrifuging receptacle 21, the user separates the cap cover 25 from the centrifuging receptacle 21 and cleans the interior.

As described above, with the cyclone dust collecting apparatus for use in the vacuum cleaner according to the preferred embodiment of the present invention, foreign
20 substances in the air are filtered out easily, without having to use a dust bag. Further, since the user can empty the contaminant receptacle 10 easily, the apparatus is easy to use and also hygienic. Furthermore, since the components are easy to assembly and disassemble, maintenance is simplified.

25

CLAIMS

1. Cyclone dust collecting apparatus for use mounted in a dust collecting chamber of a vacuum cleaner, the dust collecting chamber communicating with a motor chamber of a cleaner body, for centrifugally separating contaminants from air drawn in through a suction brush, wherein the apparatus comprises:

a contaminant receptacle having a contaminant chamber and an air discharge chamber, the contaminant chamber and the air discharge chamber respectively having open upper sides and being partitioned from each other,

- a cyclone unit connected to an upper portion of the contaminant receptacle so as to cover the contaminant chamber and the air discharge chamber, the cyclone unit having an aperture corresponding to, respectively, an incoming air port through which foreign-substance-laden air flows in, a centrifuging chamber for separating the foreign substances from the air by a centrifugal effect, a contaminant discharge port through which the separated foreign substances are discharged, an outgoing air port through which cleaned air that is left after separation of the foreign substances is discharged, and the air discharge chamber; and

a duct member connected to the upper portion of the cyclone unit, and having an air inflow channel that is connected to the incoming air port and an air outflow channel that interconnects the outgoing air port with the aperture.

2. Apparatus according to claim 1, wherein the cyclone unit comprises:

a centrifuging receptacle having an open upper end, a closed lower end and a cylindrical side that has the contaminant discharge port formed therein;

- a cover plate connected to an outside of the centrifuging receptacle, covering the contaminant chamber and the air discharge chamber, the cover plate having the aperture formed therein; and

a cap cover removably mounted on the centrifuging receptacle so as to cover the open end of the centrifuging receptacle, the cap cover having the incoming air port and the outgoing air port.

3. Apparatus of claim 2, wherein the cyclone unit further comprises a grille member having an open upper end intercommunicating with the incoming air port of the cap cover, and a plurality of fine holes formed in a side, the cyclone unit being mounted in an interior of the centrifuging receptacle.

5

4. The cyclone dust collecting apparatus of claim 3, wherein the grille member comprises:

a cylindrical body integrally formed on a bottom wall of the centrifuging receptacle, and having open upper and lower ends; and

10 a lower cover connected to cover the open lower end of the cylindrical body.

5. Apparatus according to claim 2, wherein the outgoing air port is formed in the centre of the cap cover, and the incoming air port is formed at an end of an air guide groove that is formed near to the outgoing air port in a spiral manner.

15

6. Apparatus according to claim 2, wherein the centrifuging receptacle has one or more locking grooves formed in the upper end which receives locking protrusions protruding from a rim of the cap cover to be locked in the locking grooves.

20 7. Apparatus according to claim 6, wherein the cap cover has at least a pair of handle holes formed in an upper side of the cap cover, for rotating the cap cover for locking or unlocking of the cap cover.

8. Apparatus according to claim 2, wherein the cover plate and the centrifuging
25 receptacle are integrally formed with each other.

9. Apparatus according to any preceding claim, including a sealing member between the cyclone unit and the duct member.

30 10. A vacuum cleaner having cyclone dust collecting apparatus, wherein the cleaner comprises a contaminant receptacle having a contaminant chamber and an air discharge chamber defined by side walls of the receptacle and separated from each

other by a partition, a cover extending over the contaminant chamber and the discharge chamber, and, depending from the cover so as to be located within the contaminant chamber, a receptacle defining a centrifuging chamber, the receptacle having a contaminant discharge port for the discharge of contaminants from the centrifuging chamber into the contaminant chamber, and wherein the cleaner further comprises a duct member which overlies the cover member and which has an air inflow channel arranged to communicate with the centrifuging chamber via an incoming air port of the centrifuging chamber for admitting contaminant-laden air to the centrifugal chamber, and an air discharge channel for conveying cleaned air from the centrifuging chamber to the discharge chamber via an aperture in the cover.

11. A cleaner according to claim 10, wherein the contaminant receptacle, the cover and the centrifuging receptacle defining the centrifuging chamber are removable together from the cleaner.

15

12. A cleaner according to claim 10 or claim 11, wherein the cover is a cover plate and the duct member has a sealing member, preferably in the form of a gasket, for sealing connections between the air flow channel and the incoming air port and between the air discharge channel and the aperture in the cover.

20

13. Cyclone dust collecting apparatus substantially as herein described and shown in the drawings.

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